

Appl. No. 10/500,342
Amdt. dated February 2, 2009
Reply to Office Action of September 4, 2008

PATENT

REMARKS/ARGUMENTS

This Amendment is responsive to the Office Action mailed on September 4, 2008. Attached is a Request for Continued Examination and a petition for a two-month extension of time.

In this Amendment, the specification is amended; Claims 1 and 9-11 are amended; Claims 15-21 are added; leaving Claims 1-21 pending and subject to examination. In order to advance prosecution of this Application, Applicants respond to each notation by the Examiner, and respectfully request reconsideration and favorable action in this case.

I. Examiner Interview

Applicants thank Examiner Park and Examiner Bhatnager for the telephonic interview granted on December 10, 2008. Applicants appreciate the Examiner's consideration of the arguments presented by Applicants' representative.

Pursuant to M.P.E.P. §713.04, Applicants submit that Claim 1 and U.S. Patent No. 5,920,319 to Vining et al. ("*Vining 1*") were discussed during the interview. More specifically, the passages *Vining 1* relied upon in the Office Action for teaching the limitations of "generating a shrunken version of the colon like surface utilizing neighbors averaging of the three dimensional position information for every vertex point in the original colon view" and "isolating segments of vertex points between planes normal to the curve proximate to the major axis of the colon like surface from the shrunken version of the colon like surface" of Claim 1 were discussed. Applicants' representative pointed out an inconsistency in the chronology of the steps relied upon in *Vining 1* in that the wireframe model generated in step 30 cannot be generated using the normal vectors created at a later step 40. In response, the Examiners suggested that there may be other models in *Vining 1* that are generated using the normal vectors created at step 40.

II. Future Claim Objection under 37 CFR §1.75

The Office Action advises that Claim 12 will be objected to under 37 CFR § 1.75 as being substantial duplicative, should Claim 9 be found allowable. *Office Action*, page 2, paragraph 1. Applicants thank the Examiner for the advisement and will address the objection should Claim 9 be found allowable.

III. Claim Objections under 37 CFR § 1.75(a)

Applicants thank the Examiner for withdrawing the objections under 37 CFR §1.75(a).

IV. Claim Rejection under 35 U.S.C. §101

Applicants thank the Examiner for withdrawing the rejections under 35 U.S.C. §101.

V. Claim Rejections under 35 U.S.C. §102(b)

Claims 1-6, 9-12, 13, and 14 are rejected under 35 U.S.C. §102(b) as being anticipated by *Vining 1*. Applicants traverse these rejections for the reasons discussed below.

Applicants have invented a system for determining an accurate centerline of a three dimensional computer model of a colon to more precisely determine anomalies (e.g., polyps) in a non-invasive colonoscopy. Accurately determining the centerline of a three dimensional computer model of a colon remains a challenge in prior systems. In Applicants' invention, the three dimensional computer model of the colon is substantially reduced in volume by averaging the positional information of neighboring vertexes around each vertex in the three dimensional computer model while the length of the model remains substantially unchanged. The shrunken model is segmented and the segments are mapped back to the original model to generate an accurate ring profile of the original model. The accurate centerline is computed from the accurate ring profile of the original model.

A. Claim 1 is not anticipated by Vining 1

Independent Claim 1 is not anticipated by *Vining 1* because *Vining 1* fails to describe each and every element of the claim. To anticipate a claim, each and every element

must be expressly or inherently described in the prior art reference being cited. *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). MPEP § 2131.

For example, *Vining 1* fails to teach or suggest the element of “generating a shrunken version of the colon like surface utilizing neighbors averaging of the three dimensional position information for every vertex point in the original colon view, wherein the shrunken version of the colon like surface has a same number of vertices as the original image of the colon like surface,” as recited in Claim 1, as amended.

The Office Action alleges that the three dimensional data volume created at step 34 in FIG. 1 teaches the original image of the colon like surface and that the wireframe model created at step 38 teaches the shrunken version of the colon like surface. *Office Action*, page 3, paragraph 3-page 4, paragraph 1. The Office Action also appears to allege that averaging normal vectors associated with each polygon connected to a vertex (step 40 of FIG. 1) teaches averaging of the three dimensional position information for every vertex point in the original colon view. *Office Action*, page 3, paragraph 3-page 4, paragraph 1.

Vining 1 describes segmenting a region of interest from the three-dimensional data volume at step 35. *Vining 1*, col. 5, lines 40-41. *Vining 1* describes that at the next step 37, the isosurface of the region of interest is generated. *Vining 1*, col. 7, lines 54-56. *Vining 1* describes that the isosurface is used to generate the wireframe model comprising “a polygonal mesh that corresponds to the surface of the region of interest” at step 38. *Vining 1*, col. 7, lines 57-60. *Vining 1* does not however disclose that the three-dimensional data volume has the *same number of vertices* as the wireframe model. Thus, *Vining 1* does not describe “wherein the shrunken version of the colon like surface has a same number of vertices as the original image of the colon like surface,” of amended Claim 1.

Further, *Vining 1* does not describe “generating a shrunken version of the colon like surface utilizing neighbors averaging of the three dimensional position information for every vertex point in the original colon view,” of Claim 1. *Vining 1* describes generating a normal vector at each vertex in the wireframe model by computing the average of normal vectors associated with each polygon connected to the vertex:

At step 40, a normal vector is calculated for each vertex in a the wireframe model. The direction of each normal vector is perpendicular to a plane that is tangent to the isosurface at each such vertex, typically pointing away from the object or away from the lumen of a body organ. *The normal vectors at the respective vertices can be computed as the average of the normal vectors associated with each polygon connected to that vertex. The normal vector associated with a polygon is calculated using a vector cross product.*

Vining 1, col. 8, lines 39-57 (emphasis added). The flowchart in Fig. 1 shows that the wireframe model is generated *at step 30* and the normal vector is generated *at step 40*. *Vining 1*, Fig. 1. That is, Fig. 1 shows that generating the normal vector by computing the average of normal vectors occurs after the wireframe model is generated. The averaging of normal vectors cannot be used to generate the wireframe model in *Vining 1* as the Office Action alleges because the averaging step is performed after the step that the wireframe model is generated. Thus, the cited passage does not describe “generating a shrunken version of the colon like surface utilizing neighbors averaging of the three dimensional position information for every vertex point in the original colon view,” of Claim 1.

When this inconsistency in the chronology of the steps was discussed with the Examiners during the interview, the Examiners suggested that there may be other models in *Vining 1* generated after step 40 that teach a shrunken version of the colon-like surface and that are generated utilizing the averaging of the normal vectors. The Examiners appear to be proposing a basis for a new rejection that alleges that the wireframe model teaches the original image of the colon like surface. Applicants respectfully request that the Examiners provide the details of this new rejection so that the Applicants can respond appropriately.

Moreover, *Vining 1* does not describe that the normal vectors being averaged are “three dimensional position information for every vertex point in the original colon view.” The Office Action cites the following passage as teaching this element:

The vertices of the wireframe model can be analyzed and grouped into populations having abnormal wall structure as shown at steps 40-45 in FIG. 1. At step 40, a normal vector is calculated for each vertex in a the wireframe model. The direction of each normal

vector is perpendicular to a plane that is tangent to the isosurface at each such vertex, typically pointing away from the object or away from the lumen of a body organ. The normal vectors at the respective vertices can be computed as the average of the normal vectors associated with each polygon connected to that vertex. The normal vector associated with a polygon is calculated using a vector cross product. Alternatively, the normal vector at a vertex can be computed as a weighted average of the normal vectors associated with those polygons of the wireframe model which are within a predetermined distance from a specific vertex. A third method is to compute the normal vector at a vertex, component-wise (e.g., x, y, and z), by calculating the three dimensional gradients of the local volume surrounding the vertex.

Vining 1, col. 8, lines 39-58. The cited passage describes that the direction of the normal vector is perpendicular to a plane tangent to the isosurface. The cited passage also describes computing the components of the normal vector by calculating three dimensional gradients. The cited passage does not however describe that the normal vectors are three dimensional position information. For these reasons, *Vining 1* does not describe that “generating a shrunken version of the colon like surface utilizing neighbors averaging of the three dimensional position information for every vertex point in the original colon view,” as recited in Claim 1.

Thus, *Vining 1* fails to describe “generating a shrunken version of the colon like surface utilizing neighbors averaging of the three dimensional position information for every vertex point in the original colon view, wherein the shrunken version of the colon like surface has a same number of vertices as the original image of the colon like surface,” as recited in Claim 1, as amended. Moreover, the other cited references of the Office Action do not cure this deficiency. Applicants respectfully submit that Claim 1 and its dependent claims are not anticipated by *Vining 1* and request that the rejection be withdrawn.

Independent Claims 9-12 also recite “generating a shrunken version of the colon like surface utilizing neighbors averaging of the three dimensional position information for every vertex point in the original colon view.” Thus, for similar reasons to those discussed above, Claims 9-12 and their dependent claims are not anticipated by *Vining 1*. Applicants respectfully request withdrawal of the rejection to these claims.

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VI. Claim Rejections under 35 U.S.C. §103(a)

Claim 7 is rejected under 35 U.S.C. §103(a) as being unpatentable over *Vining 1* in view of U.S. 7,194,117 B2 to Kaufman et al. (“*Kaufman et al.*”). Claim 8 is rejected under 35 U.S.C. §103(a) as being unpatentable over the combination of *Vining 1* in view of *Kaufman et al.*, and further in view of U.S. Patent No. 5,782,762 to Vining (“*Vining 2*”). Applicants traverse this rejection for the reasons discussed below.

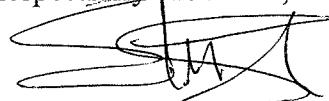
As discussed above, *Vining 1* fails to disclose or teach at least the limitation of “generating a shrunken version of the colon like surface utilizing neighbors averaging of the three dimensional position information for every vertex point in the original colon view.” *Kaufman et al.* and *Vining 2* fail to cure this deficiency. Thus, *Vining 1* fails to teach or suggest, either alone or in combination with *Kaufman et al.* and *Vining 2*, the combination of elements specifically recited in Claims 7 and 8. For this reason, Claims 7 and 8 are patentable over the combination of *Vining 1*, *Vining 2*, and *Kaufman et al.*.

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 415-576-0200.

Respectfully submitted,



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